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JOURNAL OF THE

NEW ENGLAND BOTANICAL CLUB

Conducted and published for the Club, by

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Vol. 62

November, 1960

No. 743

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The New England Botanical Club, Inc.

Botanical Museum, Oxford St., Cambridge 38, Mass.

RHODORA.—A monthly journal of botany, devoted primarily to the flora of North America and floristically related areas. Price, \$6.00 per year, net, postpaid, in funds payable at par in United States currency in Boston; single copies (if available) 60 cents. Back volumes 1-58, with a few incomplete, can be supplied at \$5.00 per volume. Volume 59—available at \$6.00. Somewhat reduced rates for complete sets can be obtained upon application.

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Address manuscripts and proofs to Reed C. Rollins,
Gray Herbarium, 22 Divinity Avenue, Cambridge 38, Mass.

Subscriptions and orders for back issues (making all remittances payable to **RHODORA**) should be sent to Albert F. Hill, Botanical Museum, Oxford Street, Cambridge 38, Mass.

Second Class Postage Paid at Boston, Mass.

Printed by
THE LEXINGTON PRESS, INC.
Lexington, Mass.

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THE GENUS XYRIS IN FLORIDA

ROBERT KRAL

The genus *Xyris* L. is represented in the United States by only one of its three sections, the section *Xyris*. The species of sect. *Xyris*, with the exception of *Xyris flexuosa* Muhl. ex Ell., are plants of moist or wet habitats. A number of species are extremely abundant upon the vast expanses of marsh, bog, and savanna afforded by the Florida lowlands. Some of the species are frequently weedy, and are aspect dominants wherever stretches of moist sands are exposed by retreating lake or pond margins, roadside ditch construction, burning, or the bulldozing of flatwoods habitats. Others abound in relatively undisturbed marsh and savanna country, often forming there solid stands on peat-muck or in shallow water. Little economic importance has been attributed to any of the species, yet fruiting spikes of *Xyris* are a significant part of the summer diet of the wild turkey in southern Florida.

The taxonomic treatments of North American *Xyris* have been, for the most part, confined to various regional studies. Chapman (1860) described the largest number of species whose types are all from Florida. Ries (1892), in treating the genus for North America, included fourteen species, illustrating some by cursory drawings of bracts and lateral sepals. Small (1933), in the last edition of the Manual of the Southeastern Flora, treated twenty species, listing all but two from Florida. Malme (1937), in the most comprehensive recent treatment of the section *Xyris*, treated all of the species included by Small, reduced two to synonymy, and described two new varieties. Since the work of Malme,

which was based entirely upon the use of herbarium material, no comprehensive revision of *Xyris* has been done. However, some of the species have been studied by Fernald (1950), Gleason (1951), and Blomquist (1955). The work of Blomquist (1. c.) is particularly useful because it contains careful considerations of vegetative characters under-emphasized in all other treatments save that of Fernald.

A principal objective of the present study was to determine whether a further evaluation of the vegetative characteristics and habitat requirements of *Xyris* could provide the means for a ready field identification of the species. Field work was begun on the genus during the summer of 1957 while the writer was in the employ of the Florida Game and Fresh Water Fish Commission. The study was continued during the fall of that year and through the summer of 1958. During this time over 1500 specimens were examined, including the *Xyris* collections of the Herbarium of the University of Florida. Later, in the early part of 1960, the author was pleased to receive on loan material of all Florida *Xyris* from the New York Botanical Garden and from the Gray Herbarium, Harvard University. This work would not have been possible were it not for the kind assistance and encouragement of Dr. Robert K. Godfrey¹ of Florida State University, Miss Lillian Arnold and Professor Erdman West of the University of Florida, and Mr. George R. Cooley, Research Fellow of the Gray Herbarium. Their help is hereby gratefully acknowledged.

Toward the end of the project it became obvious that most of the Florida *Xyris* could be readily identified by the vegetative features. Fifteen entities are treated below; fourteen are of specific rank, one a geographical variant. The known range of two (*X. drummondii* Malme, *X. scabrifolia* Harper) did not hitherto include Florida; they were previously known only from Alabama and Georgia respectively.

MORPHOLOGY

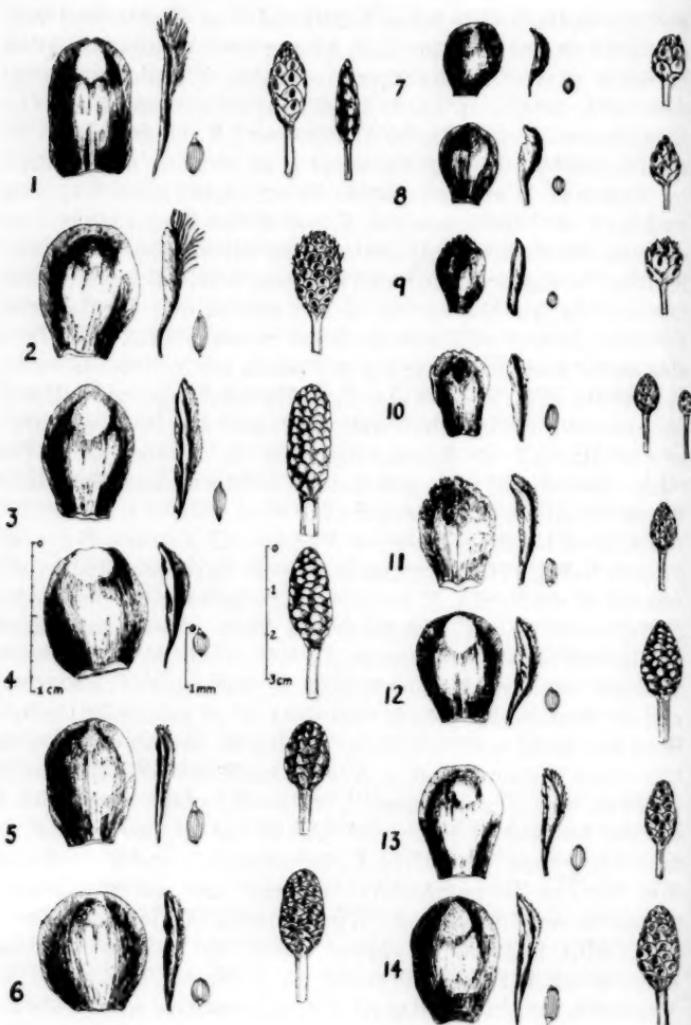
DURATION. Blomquist (1955) has stated that the duration of some of the soft-based species of *Xyris* such as *X. jupicai*

¹Expenses incurred in the field work contributing to this research were met in part by a grant from the National Science Foundation (G-2010) to Dr. R. K. Godfrey.

and *X. curtissii* (the latter here treated as *X. serotina* var. *curtissii*) is not certain; such plants may be annual in the northern part of their respective ranges, biennial or perennial to the south. In hard, or bulbous-based species such as *X. flexuosa*, *X. platylepis*, *X. ambigua*, *X. baldwiniana*, *X. elliottii*, and *X. scabrifolia*, there is an obvious perennation by means of lateral offshoots. In evidently annual species such as *X. flabelliformis* and *X. brevifolia*, there may be two or even three flowering generations per season in a given locality if moisture conditions are favorable. However, these annuals during the course of the season may also spread by short lateral offshoots to form sizeable tufts. The first species to bloom in the spring in Florida are *X. flabelliformis*, *X. brevifolia*, *X. elliottii* and *X. baldwiniana* (some southern peninsular Florida individuals reach anthesis by late February or March): by late spring or early summer all of the other species will have commenced to bloom, reaching their height by late summer or early fall.

HABIT. Florida species of *Xyris* exhibit three types of growth habit. The commonest type is that exhibited by *X. jupicai*, *X. iridifolia*, *X. serotina*, *X. smalliana*, *X. fimbriata*, *X. difformis*, and *X. flabelliformis*. These are all soft based annuals or short-lived perennials with reduced, diffuse root systems. A second type is that of *X. platylepis*, *X. ambigua*, and *X. flexuosa*, in which the plant is an evidently longer-lived perennial with a bulbous or fibrous-thickened base. A third type is exemplified by *X. elliottii*, *X. brevifolia*, *X. baldwiniana*, and *X. drummondii*, where the plant base is hard but not bulbous or thickened. All of the species have equitant, distichous foliage. In *X. flabelliformis* and *X. ambigua* this feature is particularly evident, the curvate leaves spreading out fan-like. All *Xyris* species of Florida are scapeose, with their floral organs compacted into a cone-like tough-bracted, spike. However, in *X. flabelliformis* and *X. brevifolia*, the internodes of the inflorescence are so shortened as to give a head-like appearance.

LEAVES. Features of the leaf, while of some assistance in identification, may be misleading. Shape, size, apex, and margin of leaf are too variable within the individual species to be used independently. However, the nature of the in-



Figs. 1 - 14. Bracts, lateral sepals, seeds and spikes of *Xyris*. Fig. 1. *Xyris flexuosa*; fig. 2. *X. fimbriata*; fig. 3. *X. iridifolia*; fig. 4. *X. ambigua*; fig. 5. *X. scabri-folia*; fig. 6. *X. platylepis*; fig. 7. *X. flabelliformis*; fig. 8. *X. drummondii*; fig. 9. *X. brevifolia*; fig. 10. *X. baldwiniana*; fig. 11. *X. elliottii*; fig. 12. *X. serotina*; fig. 13. *X. juncicai*; fig. 14. *X. smalliana*.

dument of the leaf surface is significant. The leaf surfaces of some species are completely smooth while those of others show degrees of scabrousness or papillosity. All the species of *Xyris* have leaves which are dilated at the equitant base. The extent, hardness, and coloration of the dilated portion are diagnostic.

SCAPE. The leaves in all species are exceeded by the elongate scape. Depending upon the species, the scape may be ribbed, prominently two-ridged, or smooth; it may be terete, blocky, or flattened in the cross-section. Scabrousness of the scape surfaces, particularly of the ridges, or ribs, is a distinctive feature, and the nature and relative length of the sheath are important characteristics.

BRACTS. The bracts of the *Xyris* spike are spirally arranged, rigid, and characterized by greenish, gray-green, or maroon subapical areas on the dorsal surfaces. The latter are generally referred to as "dorsal areas". The apices of the bracts may be entire, emarginate, or ragged, and may serve as useful taxonomic features.

FLOWERS. *Xyris* flowers are three-merous. One of the three sepals disarticulates with the corolla and/or fruit; the other two are boat-like structures which clasp the capsule laterally. These lateral sepals have keels, the nature of whose extent and margin (ciliate, lacerate, fimbriate) are critical taxonomic criteria. The spreading, three-parted corolla, the bifid staminodes, and the rest of the androecium are fairly consistent throughout the species; therefore such features are seldom used diagnostically. The filiform, trifid style disarticulates soon after anthesis; the compressed obovoid or ovoid, three-placental capsule has a papery pericarp which ruptures irregularly to disclose a large quantity of parietally arranged seeds. Relative size, color, and ribbing of the seed may be of importance in distinguishing the taxa.

DESCRIPTION OF XYRIS SECTION XYRIS

Perennial or annual, tufted or solitary, sepose herbs from a short soft, fibrous or bulbous rootstock, the roots fibrous. Leaves basal, tufted, equitant, distichous, the linear or terete-filiform blades abruptly or gradually dilated at the base. Inflorescence a contracted, compact bracteate, cone-like spike (or, more nearly, a head-like spike). Flowers perfect, zygomorphic, axillary to the leathery, imbricate bracts. Calyx of three members; the lower two boat-like, chaffy, keeled, and persis-

tent; the upper membranaceous and covering the young corolla. Corolla gamopetalous, salverform, with three equal, yellow or white lobes. Stamens three, opposite the corolla lobes, adnate to the tube; staminodes three, alternating with the corolla lobes, bifid. Ovary superior, 3-parietal; style 3-branched; stigma linear. Fruit capsular, oblong-compressed, the thin pericarp with an irregular dehiscence. Seeds small, striate, ovoid, ellipsoidal or fusiform, usually apiculate and/or caudate.

KEY TO XYRIS IN FLORIDA

1. Plant bases bulbous, fibrous-thickened, or thickened by chaffy aggregations of persistent leaf bases.
2. The plant bases bulbous or fibrous-thickened; plants solitary or in small tufts.
3. Plants tuberculate-roughened on all scape and leaf surfaces....
.....1. *X. scabrifolia*, fig. 5.
4. The plants perennating by lateral or terminal shoots; leaves spreading fanlike, scarcely twisted; dead leaf bases persistent, fibrous, shreddy; keel of lateral sepals ciliate. (Farnose-seeded, broad-scaped individuals may be found here, these identified as *X. ambigua* x *X. iridifolia*).....
.....2. *X. ambigua*, figs. 4, 22.
4. The plants perennating by lateral shoots, the bases bulbous; leaves ascending, twisted; dead leaf bases scale-like or chaffy.
 5. Base of plant deeply set in substrate, comprised of hard, castaneous, scale-like, leaf bases.....
.....3. *X. flexuosa*, figs. 1, 20.
 5. Base of plant shallowly set in substrate, comprised of fleshy, pinkish, ivory, or brown leaf bases; outermost leaves scale-like.....4. *X. platylepis*, figs. 6, 21.
2. The plant bases somewhat thickened, of hard, leathery, brown, long-persistent leaf bases; plants forming large tufts.
6. Leaf linear, but flat, with prominent pale, papillate or low-tuberculate, cartilaginous margin; scape two-or-more-ridged above, so flattened as to appear narrowly elliptic in the cross section; scapes usually narrower than the leaves; spikes seldom less than 6 mm long (but no longer than 1.5 cm), the older bracts conspicuously lacerate.....
.....12. *X. ellottii*, figs. 11, 26.
6. Leaf linear filiform, terete, blocky or somewhat flattened in fresh condition, without prominent, pale, papillate margins; scapes usually rounded or broadly elliptic in cross section above; scape ridges, if present above, low; scapes usually broader than leaves; spikes small, seldom longer than 6 mm....
.....11. *X. baldwiniana*, figs. 10, 23.
1. Plant bases neither bulbous, or fibrous-thickened, or chaffy with persistent leathery leaf bases; leaf bases, with exception of no. 7, usually soft and not persistent.

7. Leaves equalled or exceeded by the sheaths of the scape; dwarf, fliform-scaped species.
 8. The leaves broadly linear, usually over 1 mm broad, flabellately spreading; keel of lateral sepals ciliate; bracts usually entire.
 9. Sheaths of the scape about equaling the length of most of the leaves; leaves 3-6 cm. long; smooth; low perennials.....
.....5. *X. drummondii*, figs. 8, 25.
 9. Sheaths of the scape exceeding the leaves; leaves usually less than 3 cm long, papillose or minutely tuberculate; dwarf annuals, often of a pale maroon coloration.....
.....6. *X. flabelliformis*, figs. 7, 18.
 8. The leaves narrowly linear, usually 1 mm broad or less, ascending; bracts usually ragged, often purplish, at the apex; dwarf annuals.....
.....7. *X. brevifolia*, figs. 9, 24
 7. Leaves exceeding the sheaths of the scapes; taller, linear-scaped species.
 9. Plant base bright pink or purplish.
 10. Tips of lacerate sepals slightly to conspicuously exserted; tall plants of wet to inundated soils.....
.....14. *X. smalliana*, fig. 14.
 10. Tips of lacerate sepals not exserted.
 11. Seeds farinose.
 12. Scape seldom taller than 60 cm; more than two-ridged or angled above, the ridges scabrous; mature spikes ovoid, never more than 1.5 cm long
.....9. *X. serotina* var. *serotina*, figs. 12, 17.
 12. Scape seldom less than 60 cm long, conspicuously flattened and two ridged above, the margins broad and smooth; mature spikes oblong or narrowly ovoid, rarely less than 1.5 cm long.
.....8. *X. iridifolia*, figs. 3, 15.
 11. Seeds not farinose.
 13. Scapes more than 2-ridged above, all the ridges scabrous, and broadly elliptic in the cross section above.....10. *X. serotina* var. *curtissi*.
 13. Scapes seldom more than 2-ridged above, definitely and broadly flattened beneath the spike, therefore narrowly elliptical in the cross section.....
.....16. *X. difformis*.
 9. Plant base tan, greenish, or yellowish-green.
 14. Lateral sepals exserted; spikes seldom less than 1.5 cm long.
 15. The upper keel of the lateral sepals fimbriate; ridges of the scape rough to the touch.....
.....13. *X. fimbriata*, figs. 2, 16.
 15. The upper keel of the lateral sepals lacerate; ridges of the scape smooth to the touch (under magnification may be distantly low-tuberculate).....

14. Lateral sepals not exserted; spikes seldom more than 1.5 cm long; scape ridges usually papillose, minutely scabrid, or tuberculate.
16. Leaves broadened at or above the middle, often flabellately arranged; scape conspicuously broadened and flattened above.....16. *X. difformis*.
16. Leaves linear, ascending; scape not conspicuously broadened and flattened above.....
.....15. *X. jupicai*, figs. 13, 19.

TREATMENT OF THE SPECIES

1. *Xyris scabrifolia* Harper, Bull. Torrey Bot. Club 30: 325. 1903. Fig. 5. Solitary, bulbous based, perennials, superficially resembling *X. platylepis*. Leaf linear, 30-40 cm long, 5-10 mm broad, twisted, *striate-scabrid* throughout, acute or blunt, the equitant portion about 1/8 the total leaf length, abruptly flaring at the pale brown, ultimately fibrous, base. Scape 60-90 cm long, twisted and sometimes flexuous, terete and multicarinate below, 2 to 4 carinate above, *striate-tuberculate between the scabrid ridges*. Sheath of the scape 8-12 cm long, with a short blade. Spike 11-20 mm long, obovoid or ellipsoid, of many tightly imbricate bracts. Fertile bracts 6-8 mm long, obovate, entire, or somewhat erose with age, dull reddish-brown or brown with a broadly elliptic or rhombic gray-green dorsal area. Lateral sepals inserted, about the length of the subtending bract, brown, the ascending-lacerate keel broadening toward the summit. Seeds fusiform-caudate, 0.6-0.9 mm long, pale and transparent.

Moist to wet sandy peats of acid sphagnum bogs, northwest Florida and central Georgia.

Type. GEORGIA. MERIWETHER CO.: open bog near Woodbury, Harper 1254.

Representative specimens. FLORIDA. ESCAMBIA CO.: hillside bog along Bayou San Marcus Creek, w. of Pensacola, Kral & Godfrey 6000. LIBERTY CO.: boggy seepage slopes along small tributary of Taluga River 1.7 mi. w. of Hosford, Thorne & Davids 16453. WASHINGTON CO.: cypress-gum pond, 3.5 mi. e. of Caryville, Kral & Godfrey 6000a.

2. *Xyris ambigua* Beyr., Kunth, Enum. Pl. 4: 12. 1843. Figs. 4, 22. ?*Xyris stricta* Chapm., Fl. S. U. S. 500. 1860. Solitary or tufted, hard and fibrous-based perennials. Leaf *spreading, broadly linear*, 15-40 cm long, 3-15 mm broad, curvate, flat or slightly twisted, minutely tuberculate along the margins, elsewhere smooth; tips blunt to narrowly acute; bases *conspicuously and abruptly dilated, fibrous, long persistent*, the equitant portion 1/4-1/2 the total leaf length, brownish. Scape 70-100 cm long twisted, terete and multicarinate below, usually somewhat flattened and bicarinate above, the ridges minutely tuberculate; sheaths of the scape 10-20 cm long, the short ascending blade comprising less than 1/4 the total sheath length. Spike 1.5-3.0 cm long, narrowly elliptical to oblanceolate in outline, blunt to acute, of many, closely imbricate bracts. Fertile bracts 8-10 mm long, broadly obovate

to orbicular, entire to somewhat erose at the apex, reddish-brown to pale brown with a roughly rectangular, olive to dark brown dorsal area. Lateral sepals inserted, tan to reddish, about 1 cm long with a broad, *ciliate* keel. Seeds ovoid to ellipsoidal, 0.4-0.5 mm long, many ribbed.

Moist sands or sandy-peats of bog margins, savannas, flatwoods pond margins, lakeshores and roadside ditches, North Carolina south to Florida, west in the Coastal Plain to Texas.

Type Locality. According to Malme (1937) the type is from "margins of swamps, Georgia". The present author has not examined it.

Florida material examined, by county. Baker, Bay, Brevard, Calhoun, Charlotte, Citrus, Duval, Escambia, Flagler, Franklin, Gulf, Hernando, Hillsboro, Indian River, Jefferson, Lake, Lee, Leon, Levy, Liberty, Okaloosa, Orange, Palm Beach, Pasco, Pinellas, Polk, Santa Rosa, Sarasota, Sumter, Volusia, Wakulla, Washington.

Although *Xyris ambigua* does occur in bogs, usually it does not occur in areas of standing water; rather, it is a plant of the upper margins of boggy habitats. In the herbarium at Florida State University, there is an unusual specimen, superficially resembling *X. ambigua*, that was collected from the shallow water of a cypress pond (Franklin Co., Florida; in shallow water, cypress-gum swamp 7 mi. n. of East Point, Godfrey 55724). Because of the atypical habitat the collection was examined in detail. It was discovered that this population has farinose seeds and much broader and flatter upper scapes than are common to *X. ambigua*. I was interested to note the similarity between this Godfrey collection and the type and isotype specimens of *Xyris stricta* Chapm. (*Florida*. Franklin Co.: "Appalachicola, Chapman") kindly sent from the New York Botanical Garden and from the Gray Herbarium. Chapman (1860) described a more aquatic situation for his *X. stricta* than is usual for *X. ambigua*. The latter is a plant of moist, certainly not wet, habitats; thus there is also agreement, habitatwise, between the Chapman and the Godfrey collections.

Only one *Xyris* of northwest Florida (*X. iridifolia*) has a tall habit combined with a conspicuously flattened upper scape and farinose seeds together with an aquatic habitat. That these features appear in *X. stricta* Chapm. together with a predominance of characteristics of *X. ambigua* leads one to suspect the former to be a hybrid. I have annotated all such specimens with the formula "*Xyris ambigua* Beyr. x

Xyris iridifolia Chapm." with the hope of studying the living plants some time during the summer or fall of 1960.

3. *Xyris flexuosa* Muhl. ex. Ell., Sk. Bot. S. C. & Ga. 1: 51. 1816. Figs. 1, 20. *Xyris torta* Kunth, Enum. Pl. 4: 14. 1843, not *X. torta* Smith, 1818. *Xyris arenicola* Small, Fl. SE. U.S. 234. 1903, not *X. arenicola* Miq. 1844. Solitary or tufted, bulbous-based perennials, the *castaneous bases deeply set in the substrate*. Leaf linear, 20-50 cm long, 2-5 mm broad, ascending, twisted and flexuous, fleshy, minutely tuberculate along the margins, otherwise smooth and lustrous; tip blunt to acute; *base abruptly dilated, dark brown, shiny, long persistent as shreddy scale*; equitant portion 1/4-1/3 the total leaf length, brownish. Scape 50-110 cm long, twisted, flexuous, smooth to minutely ridged and terete below, oval in cross section and smooth to 1-ridged above, the ridges, if present, minutely tuberculate; sheath of the scape 10-15 (-17) cm long, close, the blade comprising 1/9 or less of the total sheath length. Spike 1.5 (-1.3) -3.0 cm long, elliptic to narrowly oblanceolate in outline, blunt to broadly acute, of few to many closely imbricate bracts. Fertile bracts 0.5-1.0 (-1.3) cm long, oblong to obovate, entire or emarginate, becoming erose, reddish-brown to tan with an elliptic or rectangular gray-green to brown dorsal area. Lateral sepals *slightly to conspicuously exserted*, tan to reddish-brown with a broad, finely dissected *keel* which is fimbriate at the apex. Seeds fusiform, about 1 mm long, caudate, many ribbed.

Moist sands of pine flatwoods or savannas; well drained sands or lower reaches of scrub oak-pine barrens, New Jersey to Florida, west to Texas and Arkansas.

Type. According to Dr. Harper (1905), who was the first to clearly interpret this species, the name *X. flexuosa* first appears in the first edition of Muhlenberg's Catalogue (1813), but the first description of it does not appear until 1816 in Elliott's Botany of South Carolina and Georgia. The description of Elliott defines the species adequately.

Florida material examined, by county. Alachua, Brevard, Calhoun, Charlotte, Citrus, Collier, Columbia, Escambia, Flagler, Franklin, Gulf, Hernando, Highlands, Holmes, Indian River, Jefferson, Leon, Lake Manatee, Nassau, Okaloosa, Orange, Pasco, Pinellas, Putnam, Santa Rosa, Seminole, Sumter, Volusia, Wakulla, Washington.

Of all the Florida *Xyris*, *X. flexuosa* is the only species found on relatively dry sites. It may occur in savannas, often in close proximity to palmetto clumps, but generally where there are deep sands and little standing water. Doubtless the deeply set, thickened plant base so unique to this species is associated with its occurrence in the drier habitats.

There are two forms of *X. flexuosa*. One, by far the most common over the total range of the species, is yellow-flowered. The other, of less frequent occurrence, is white-flowered

and had been designated as a species by Small (*X. pallescens* Small, Man. SE. Flora, 1933). This form becomes increasingly abundant the farther south one goes in Florida until, in the moist sands of the south-central peninsular flatwoods, it is encountered as frequently as the yellow flowered form.

4. *Xyris platylepis* Chapm., Fl. S. US. 501. 1860. Figs. 6, 21. Solitary (or in clumps of a few plants), *bulbous based perennial*, the base *superficial on the substrate*. Leaves, except for the outermost scale-like ones, linear, 20-40 (50) cm long, 5-10 mm broad, twisted, ascending, flexuous, fleshy, minutely tuberculate along the margin, otherwise smooth; tip blunt to acute; equitant portion 1/3-1/2 the total leaf length, its base *abruptly dilated, ivory white or pink*. Outermost leaves *scale-like*, quickly aging to a dull brown color, persisting on the base but a short time after anthesis. Scape 50-120 cm long, twisted, sometimes flexuous, many ridged and terete below, 2, 3 or 4-ridged and slightly flattened above, the ridges scabrous. Spike broadly elliptic to ovoid or oblong, 1.5-3.0 (-4.0) cm long, of numerous, closely imbricate bracts. Fertile bracts obovate, 5-7 mm long, entire, with an oblong to deltoid dark green dorsal area. Lateral sepals inserted, tan, with the keel broadly and finely lacerate-winged above. Seeds ellipsoidal, about 0.5 mm long.

Moist to wet sands or sandy peats of pineland pond margins, savannas, bogs and marshes, Florida to Virginia, west in the Coastal Plain to Louisiana.

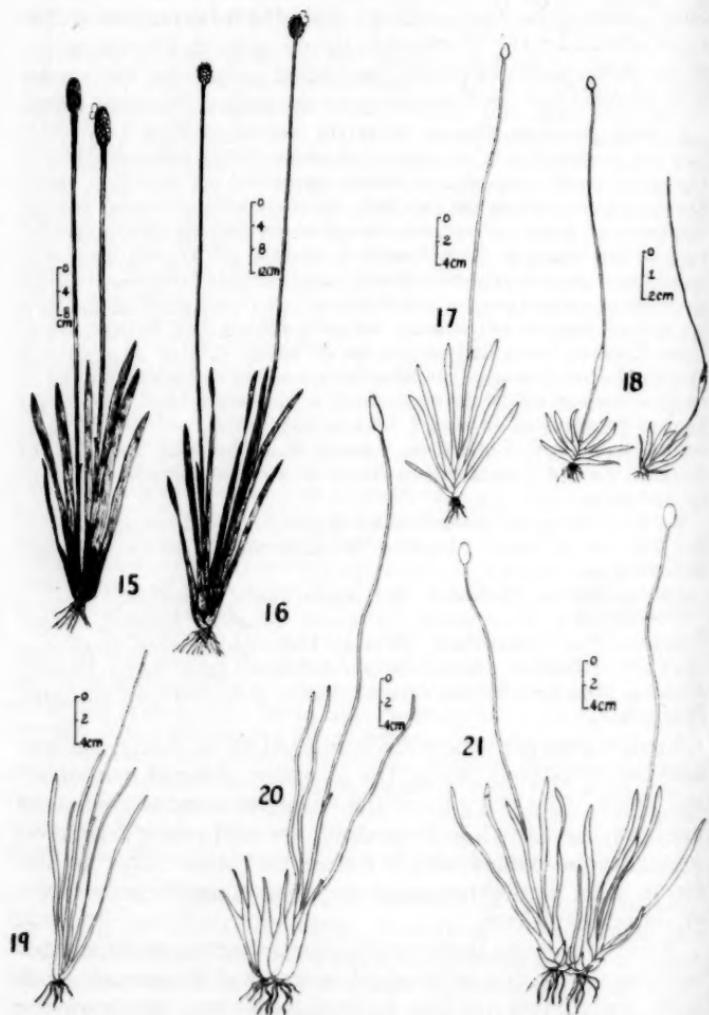
Type. FLORIDA, FRANKLIN CO.: Apalachicola, Chapman.

Florida material examined, by county. Alachua, Brevard, Citrus, Columbia, Duval, Franklin, Gadsden, Hamilton, Hardee, Hernando, Highlands, Hillsboro, Indian River, Jefferson, Leon, Levy, Liberty, Madison, Manatee, Marion, Orange, Pasco, Polk, Putnam, St. Lucie, Seminole.

Xyris platylepis is best distinguished by its fleshy, bulbous base which is made up of the abruptly widened, succulent, leaf bases. The margins of the lower portions of the leaves are transparent, while from the inner surfaces a gelatinous substance is exuded which makes the plant slimy to the touch. Also distinctive are the scale-like, appreciably shorter, outermost leaves.

Xyris platylepis is not truly aquatic, although it may occasionally be found in the shallow water of temporary pools. Such individuals are less bulbous-based and, although the bases usually keep their ivory white or pinkish coloration and scale-like outer leaves, the plants are somewhat reminiscent of taller specimens of *X. difformis*.

Xyris platylepis shows the same petal color variation as



Figs. 15 - 21. Outline sketches of some *Xyris* species. Fig. 15. *X. iridifolia*; fig. 16. *X. fimbriata*; fig. 17. *X. serotina*; fig. 18. *X. flabelliformis*; fig. 19. *X. juncicai* (leaves and plant base); fig. 20. *X. flexuosa*; fig. 21. *X. platylepis*.

does *X. flexuosa*, at least in southern peninsular Florida where white-flowered plants are not infrequent. When such forms are in evidence, not only is the entire population white flowered, but also neighboring populations of *X. flexuosa*.

5. *Xyris drummondii* Malme, Ark. Bot. 25A: 14. 1933. Fig. 8. Solitary or tufted, soft-based, biennial (perennial?). Leaf broadly linear, 3-6 cm long, 1.5-3 mm broad, smooth or slightly papillose toward the base; tip acute to acuminate; equitant portion conspicuously dilated, green, with an *abruptly castaneous base*. Scape 22-30 cm long, slightly twisted, ribless and oval to terete below, 1-2 ribbed and somewhat flattened above, the ribs smooth or papillose; *scape sheath about the length of the leaves*, the ascending blade about 1/3 the total length of the sheath. Spikes 7-10 mm long, narrowly ovoid, of a few loosely imbricate bracts. Fertile bracts 3-5 mm long, ovate to broadly elliptic, entire, carinate, light to dark brown with a paler, inconspicuous elliptic dorsal area. Lateral sepals inserted, falcate, about the length of the bracts, *ciliate-keeled*. Seeds about 0.5 mm long, ovoid, many ribbed, the ribs inconspicuous.

Sandy-peats of roadside ditches or hillside bogs, Coastal Plain, West Florida, Alabama and Mississippi.

Type. Specimens collected by the author, or by Dr. Godfrey, conform so closely to the description of the species by Malme (1937) and differ so significantly from either *X. brevifolia* or *X. flabelliformis*, that it seems reasonably certain that they should be included as new records for *X. drummondii*. Malme (1. c.) states only "Alabama" as the type locality, the collection presumably one by Drummond.

Xyris drummondii is but one of three diminutive species of *Xyris* now known to occur in Florida. It is readily separable from either *X. flabelliformis* or *X. brevifolia* by its perennial nature, its scape sheaths which are equal to the leaves in length, and by the conspicuous reddish-brown patches at the leaf bases. Hitherto known only from the type locality in Alabama, it is here recorded for west Florida and southeastern Mississippi: FLORIDA. ESCAMBIA CO.: hillside bog along Bayou San Marcus Creek, w. of Pensacola, Kral & Godfrey 5999. LIBERTY CO.: wet pine flatwoods, 8 mi. s. Hosford, Godfrey 55683. MISSISSIPPI. GEORGE CO.: 7 mi. n. w. Wilmer on sandy peaty clay of hillside bog, Kral 7135.

6. *Xyris flabelliformis* Chapm., Fl. S. US. 499. 1860. Figs. 7, 18. Solitary or tufted, soft-based annuals. Leaf broadly linear, spreading, 1-3 cm long, 1-3 mm broad, *curvate, flabellately arranged*, smooth, or striate-papillose with a papillose or low-tuberculate margin, maroon or greenish brown; tip acute; *equitant portion conspicuously inflated and hyaline-margined toward the base* and comprising 50-60 percent of the total leaf length. Scape 10-30 cm long, filiform, twisted, terete or with one or two low ridges above, smooth; scape sheath exceeding all or most of the leaves, the ascending blade up to 1/3 the total length

of the sheath. *Spike* 0.5-1.0 cm long, ovoid, ellipsoid or globose, of a few, loosely imbricate bracts. *Fertile bracts* 3-5 cm long, ovate to elliptic or obovate, entire (occasionally somewhat lacerate with age), slightly carinate, greenish-brown or tan with a pale green, papillose dorsal area. *Lateral sepals* inserted, *falcate*, the *keel* finely but evenly ciliate. Seeds about 0.5 mm long, ellipsoid, striate.

Exposed wet sands of savanna-bogs, pineland pool margins and roadside ditches, northeastern Florida north and west along the Gulf to Mississippi.

Type. FLORIDA. FRANKLIN CO.: "Apalachicola, Chapman".

Florida material examined, by county. Alachua, Baker, Citrus, Dade, Duval, Franklin, Flagler, Gulf, Hamilton, Hernando, Jefferson, Madison, Lee, Leon, Levy, Putnam, Suwannee, Wakulla.

Xyris flabelliformis, together with *X. brevifolia*, is one of the first of the genus to flower in the spring and may be an aspect dominant on any area of wet, disturbed sands within its range. While it has often been mistaken for *X. brevifolia* it may be distinguished from the latter by its softer base, its entire bracts, and by its relatively shorter, broader leaves which are curvate, flabellately arranged and usually of a maroon tint. While the keel of the lateral sepals of *X. flabelliformis* is finely ciliate, that of most specimens of *X. brevifolia* ranges from entire to papillose or minutely tuberculate.

7. *Xyris brevifolia* Michx., Fl. Bor. Am. 1: 23, 1803. Figs. 9, 24. Solitary or tufted, *hard-based annual*. Leaves narrowly linear, ascending, 2-5 (-7) cm long, 0.5-2.0 mm broad, flat or slightly twisted, smooth or with a low-tuberculate margin; tip acute; equitant portion abruptly inflated toward the brown, hard base. Scape 10-40 cm long, filiform, terete, or with one or two low ridges above, smooth; sheath of the scape exceeding all or most of the leaves, the ascending blade up to 1/4 the total sheath length. Spikes about 0.5 cm long, ovoid or globose, of a few loosely imbricate bracts. *Fertile bracts* 3-5 mm long, ovate to narrowly obovate, *lacerate*, greenish-brown save for the *maroon, lacerated apical portion* and the dark green or dark reddish-green elliptic dorsal area. *Lateral sepals* inserted, *curbed* or *striate*, the *keel smooth or finely tuberculate* (very rarely ciliate). Seeds about 0.5 mm long, ellipsoid, striate.

Exposed wet sands of pine flatwoods, pineland pond margins, grass-sedge bogs, and roadside ditches, North Carolina to Florida and west along the Coastal Plain to Alabama.

Type. Wet meadows, Coastal Georgia, Michaux. Not seen.

In north Florida I have often observed this species intermixed with *X. flabelliformis*; it is best distinguished from the latter by its longer, proportionately narrower leaves. its

lacerate (sometimes squarrose) bracts, its tough leaf bases and its tendency to form clumps of dozens of individuals. In fact, *X. brevifolia* exhibits many features of the perennial, clump-forming, *X. elliottii* which has hard-based, linear leaves and lacerate bracts. As one travels south through the flatwoods of peninsular Florida, enormous mixed populations of both species are encountered and the similarity between the two becomes the more striking. Yet, as one travels north and west in Florida, into the optimum range of *X. flabelliformis*, populations of *X. brevifolia* are frequently broader leaved, softer-based, and show a closer affinity to *X. flabelliformis*. Obviously, this is a highly plastic species; detailed population studies may show at least two distinct races.

Florida material examined, by county. Alachua, Baker, Bradford, Brevard, Charlotte, Citrus, Columbia, DeSoto, Duval, Franklin, Hamilton, Hernando, Highlands, Hillsboro, Indian River, Jefferson, Lee, Leon, Levy, Liberty, Manatee, Marion, Orange, Pinellas, Putnam, Sarasota, St. Johns, St. Lucie, Sumter, Taylor, Union, Volusia, Wakulla.

8. *Xyris iridifolia* Chapm., Fl. S. US. 501. 1860. Figs. 3, 15. Solitary or tufted, soft-pink or purplish-based perennials (biennials?). Leaf linear, iridiform, 40-70 cm long, 10-20 mm broad, flat or slightly twisted, smooth; tip broadly acute to blunt; base slightly dilated, the *equitant* portion about 1/5 the total leaf length, *pink or pale maroon* with a broad hyaline margin. Scape 60-90 cm tall, slightly twisted, terete and 2 ridged below, *conspicuously broadened and flattened above, the edges smooth* (at least under 10x magnification); *sheathes of the scapes pink or maroon-based*, about 20 cm long, with the ascending blade comprising over 1/2 the total sheath length. Spike 2.0-3.5 cm long, oblong, to broadly oblanceolate in outline, of many, closely imbricate bracts. Fertile bracts 6-7 mm long, broadly obovate to orbicular, entire, *dark purplish or reddish-brown, shining except for the paler green or gray-green oval or roughly triangular dorsal area. Lateral sepals inserted, castaneous, 5-7 mm long, with a broad, jagged to finely dissected keel. Seeds about 0.8-1.0 mm long, narrowly fusiform many-ribbed, farinose.*

Wet sands or muck of stream banks, marshes, or pineland pond margins, sometimes with the bases submerged, North Carolina to north Florida, west in the Coastal Plain to Texas.

Type. FLORIDA. FRANKLIN CO.: Apalachicola, Chapman.

Florida material examined, by county. Calhoun, Escambia, Franklin, Liberty, Okaloosa, Washington.

Xyris iridifolia, like *X. smalliana* and *X. fimbriata*, is a robust plant of marshy habitats, but is distinguished from

both of these species by the rich purplish or pinkish coloration of its leaf and scape bases, its relatively broad leaf outline (1 - 2 or 2.5 cm), its proportionately broader scape, and its thick, oblong, maroon-tinted spikes. These features, in addition to the farinose seed character, make *X. iridifolia* easily distinguishable. Putative hybrids of *X. iridifolia* with *X. ambigua* (Godfrey 55724) and with *X. fimbriata* (Kral & Godfrey 5954) have been collected in west Florida. Plants of the latter series of specimens have the farinose seeds and maroon pigmentation of *X. iridifolia*, but the general aspect and exserted sepals of *X. fimbriata*.

9. *Xyris serotina* Chapm., Fl. S. US. 500. 1860. Figs. 12, 17. Solitary or tufted, *soft-purplish-based*, annuals or perennials. Leaf linear, 5.5-25.0 cm long, 2-7 (-9) mm broad, flat or slightly twisted, the margin *tuberculate-scabrid*, the surfaces *papillose to striate-tuberculate*; tip broadly acute to acuminate; equitant portion but slightly dilated, 1/2-1/4 the total leaf length, *pink, greenish-maroon, or purplish with a pale, papillose, hyaline margin*. Scape 40-60 (-70) cm tall, slightly twisted, multicostate and terete below, 2-5-ridged and roughly oval in cross section above, the *ridges tuberculate-scabrid*, the intercarinal areas smooth or papillose; scape sheath 3-7 cm long, purplish, pinkish or brownish based, close, the narrow, ascending sheath blade about 1/3 the length of the sheath. Spike 1-1.5 cm long, ovoid-acute or ovoid apiculate, of many closely imbricate bracts. Fertile bracts 4-6 mm long, broadly obovate to orbicular, entire, reddish-brown to brown save for the dull green to contrasting brown, papillose, oval or obovate dorsal area. Lateral sepals inserted or exserted, castaneous, about 5 mm long, with a broad, jagged to finely cut keel. Seeds broadly ellipsoid, about 0.5 mm long, many-ribbed, *farinose*.

Moist exposed sands or peats of pine flatwoods, roadsides and savannas, Florida west to Mississippi.

Type. FLORIDA. FRANKLIN CO.: Apalachicola, Chapman.

10. *Xyris serotina* Chapm. var. *curtissii* (Malme), comb. nov., based on *Xyris curtissii* Malme, Ark. Bot. 13: 24. 1913.

As the species, but with leaves tending to be elliptic linear; seeds not farinose but a deep, clear yellow or amber.

In the same habitats as the species, southeastern Virginia south in the Coastal Plain to Florida, west to Mississippi.

Type. FLORIDA. DUVAL CO.: near Jacksonville, Curtiss 4316.

Upon comparing the description of Malme (1937) for *X. serotina* and *X. curtissii*, and upon consultation of the type specimens of both, I was able to find but one significant qualitative difference — that of farinose seed for the former, clear seed for the latter. Examination of a series of specimens of

both shows that there are no consistent differences of height, spike size or shape, leaf shape, indument or habit. If their ranges were co-incidental, these two entities might well be considered forms of a polymorphic species, yet the range of *X. curtissii* Malme extends north to Virginia while that of *X. serotina* Chapm. is, so far as is now known, confined to peninsular Florida and the Gulf Coastal Plain. It seems better therefore, to treat these two as geographical varieties.

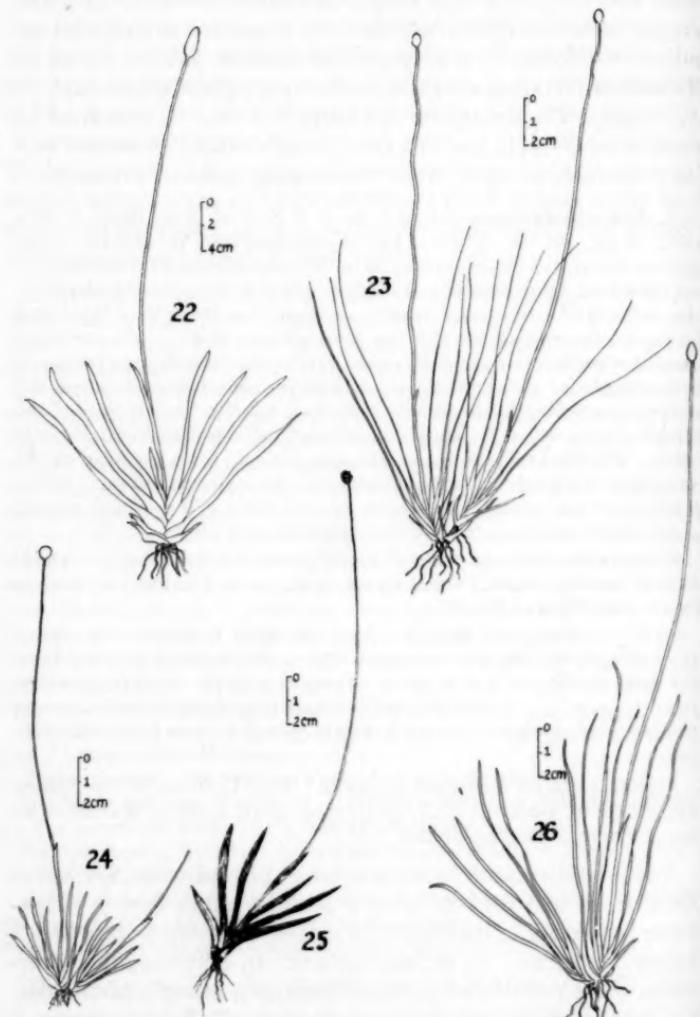
11. *Xyris baldwiniana* Schultes, in R. & S. Syst. Veg. Mant. 1: 351. 1822. Figs. 10, 23. Tufted, hard-brownish-based perennials. Leaf filiform-terete (or blocky to elliptic in the cross section of dried material), 10-30 cm long, straight or slightly twisted, smooth; equitant portion 1/8-1/6 the total leaf length, more or less abruptly dilated and brown to castaneous toward the base. Scape 20-40 (-50) cm long, usually broader than the leaf, terete below, one-ridged and tending to be terete above; sheath of the scape 7-15 cm long, brownish based, the narrow, ascending blade usually less than 1/5 the total length of the sheath. Spike 4-6 (-7) mm long, ellipsoid, of a few tightly imbricate bracts. Fertile bracts ovate or obovate, 4-5 mm long, lacerate at the apex, dull brownish with an elliptic, dull green, dorsal area. Lateral sepals inserted, about the length of the bracts, the wings ragged above. Seeds ellipsoid, about 0.5 mm long, many ribbed.

Moist sands or sandy peats of pine flatwoods, hillside bogs, roadside ditches, and savannas, North Carolina south to Florida and west in the Coastal Plain to Texas.

Type. According to Malme (1937) the type locality is "wet pine-barrens near St. Mary's, Georgia". The writer has not seen the type, but has examined the type of *Xyris tenuifolia* Chapman which, from the description of Malme (who treats it as *Xyris baldwiniana* var *tenuifolia* (Chapm.)), is only a flatter-leaved version of *X. baldwiniana*.

Florida material examined, by county. Bay, Calhoun, Duval Escambia, Franklin, Gadsden, Gulf, Highlands, Levy, Liberty, Marion, Nassau, Putnam, Wakulla, Walton.

Xyris baldwiniana is most often confused with *X. elliottii* Chapm., a tuft-former with a similar habit, but it differs from the latter in its narrower leaves, its more or less terete upper scape, and its smaller spikes. In addition, the sometimes quite prominent pale cartilaginous margin of the flatter leaves of *X. elliottii* is lacking in *X. baldwiniana*. A difference that is particularly noticeable in the field is the stout, evidently terete appearance of the scapes of *X. baldwiniana*; the scapes of *X. elliottii* appear much more slender.



Figs. 22 - 26. Outline sketches of some *Xyris* species. Fig. 22. *X. ambigua*; fig. 23. *X. baldwiniana*; fig. 24. *X. brevifolia*; fig. 25. *X. drummondii*; fig. 26. *X. eliottii*.

in relation to the leaves, and they are often somewhat flattened distally. A very good floral difference is emphasized by Dr. Blomquist (1955); the staminodes of *X. baldwiniana* are quite smooth while those of all other North American *Xyris* are fimbriate.

12. *Xyris elliottii* Chapm., Fl. S. US. 500. 1860. Figs. 11, 26. Tufted, *hard-shiry-brown-based* perennials, often in clumps of 100 or more. Leaf linear to narrowly linear, 10-30 cm long, 1-2 (-2.5) mm broad, flat to slightly twisted, minutely tuberculate to smooth along the *pale, prominent, cartilaginous margin*, otherwise papillose or smooth; tip acute to acuminate; equitant portion 1/8-1/4 the total length of the leaf, the *base hard, brown, abruptly but not broadly dilated, often persistent as chaffy fragments*. Scape 40-60 (-70) cm long, slightly twisted, terete with one to several low ridges below, oval or somewhat flattened in cross section and smooth (or with up to four low ridges) above, the ridges if present minutely tuberculate; sheath of the scape close, 8-14 cm long, with a short, ascending blade. Spike 6-15 mm long, broadly elliptic to ovoid, acute, of several closely imbricate bracts. Fertile bracts 5-6 mm long, obovate, *shreddy at the apex at maturity*, pale to dark brown, dull, with a dull, gray-green, oval or oboval, papillose, dorsal area. Lateral sepals as long as, or slightly longer than, the bracts, the keel increasingly ragged or ascending fimbriate toward the apex. Seeds 0.5-0.6 mm long, ellipsoid, many ribbed.

Moist sands or sandy peats of savannas, pineland pond margins, lakeshores, and roadside ditches, South Carolina south to Florida and west in the Coastal Plain to east Texas.

Type. FLORIDA, FRANKLIN CO.: Apalachicola, Chapman.

Florida material examined, by county. Alachua, Brevard, Broward, Charlotte, Citrus, Clay, Collier, Columbia, Dade, Duval, Flagler, Franklin, Gulf, Hardee, Hernando, Highlands, Hillsboro, Indian River, Lafayette, Lake, Lee, Leon, Levy, Liberty, Manatee, Marion, Martin, Nassau, Okaloosa, Orange, Osceola, Palm Beach, Pasco, Pinellas, Polk, Putnam, Santa Rosa, Sarasota, St. Johns, Sumter, Taylor, Union, Volusia, Wakulla, Washington.

Xyris elliottii is a gregarious species, often forming clumps of a hundred or more plants. During the early summer months the borders of many peninsular Florida lakes and ponds are turned to gold by countless thousands of flowering spikes of this species. The narrowly linear, sometimes twisted leaves of *X. elliottii* are usually cartilaginous-margined. This margin becomes particularly conspicuous on the herbarium specimen, showing as a fine white to yellowish-white (usually papillate) band in sharp contrast to the blade proper which dries to a dark green or brown.

However, leaf-widths and -lengths are highly variable in *X. ellottii*. A narrower-leaved form with minor differences such as a less prominent margin, less scabrous scape, shorter bracts and smaller heads was given varietal status by Malme (*X. ellottii* var. *stenotera*). Further study and evaluation of this latter putative entity and of Malme's *X. baldwiniana* var. *tenuifolia* are desirable.

The hard spikes of *X. ellottii* have a dull brown appearance. This effect is augmented by the ragged apices of the bracts. Some individuals have been described as having slightly exserted sepals, yet this is not reliable as a field character. The drying of specimens often causes expansion and opening of the bracts which makes the lateral sepals far more conspicuous than they are on the living plants.

13. *Xyris fimbriata* Ell., Bot. S. C. & Ga. 1: 52. 1816. Figs. 2, 16. Solitary or tufted, soft-based biennials (perennials?). Leaf broadly linear, 40-70 cm long, 5-20 mm broad, flat, smooth; tip acute to acuminate; equitant portion about 1/8 the total leaf length, its base usually tan or pale green, slightly dilated. Scape 80-130 cm long, slightly twisted, terete and 1-many ribbed below, 2 to 3 or 4-ribbed and somewhat flattened above, the *ridges evidently tuberculate-scabrid*; sheath of the scape 15-40 cm long, short-bladed. Spike 1.2-2.5 cm long, elliptic-oblong, obovate to oval, entire, dull brown, with a roughly triangular or oval, gray-green, dorsal area. *Lateral sepals conspicuously exserted*, 8-10 mm long, the *lacerate keel expanding into a broadly fimbriate tip*. Seeds 0.8-1.0 mm long, narrowly fusiform, many ribbed.

Sands and peat mucks of pineland pools, roadside ditches, cypress ponds and lake shores, New Jersey south to Florida and west in the Coastal Plain to Mississippi. I have examined Nash's specimen No. 1461 which was cited as an example by Malme (1913).

Type. Type locality "Georgia".

Florida material examined, by county. Bay, Brevard, Dixie, Escambia, Franklin, Highlands, Indian River, Jefferson, Lake, Leon, Madison, Marion, Orange, Santa Rosa, Volusia, Walton, Washington.

Xyris fimbriata is perhaps the tallest species of *Xyris* in our area. It is distinguished from all of our other *Xyris* by its conspicuously exserted, long-fimbriate lateral sepals which give the ovoid spikes a dull brown, shaggy appearance. Seldom is it found in habitats where there is not some standing water; in peninsular Florida it forms heavy stands on the mucks of cypress pond margins or on the submerged sandy peats of *Hypericum* ponds. In such habitats it is frequently found in mixed population with *X. smalliana*



Fig. 27. Distribution maps of 15 species of *Xyris* in Florida.

which it superficially resembles. Yet, in no instance do the two species appear to hybridize.

14. *Xyris smalliana* Nash, Bull. Torrey Bot. Club 22: 159. 1895. Fig. 14. Solitary to tufted, soft-based, biennials (perennials?). Leaf linear, 30-50 (-60) cm long, 5-15 mm broad, flat or slightly twisted, smooth; tip acute to acuminate; equitant portion 1/16-1/4 the total leaf length, gradually expanding toward the pale green to greenish-tan base where it becomes abruptly dilated. Scape 70-150 cm long, terete and ribless (or 1-ribbed) below, 1-2 ridged and somewhat flattened above, *smooth*; sheath of the scape 15-40 cm long, the erect blade about 1/8 the total length of the sheath. Spike 1.5-2.5 cm long, ellipsoidal or narrowly ovoid, of many closely imbricated bracts. Fertile bracts 5-8 mm long, ovate, entire, shiny brown, with a gray-green elliptic dorsal area. *Lateral sepals slightly to conspicuously exserted*, the jagged keel broadening toward the sepal tip. Seeds 0.6-1.0 mm long, fusiform, inconspicuously ribbed.

Sands and peat-mucks of pineland pools, roadside ditches, cypress ponds, and lake shores, Florida north to Georgia, west along the Gulf Coastal Plain to Louisiana.

Type. FLORIDA. LAKE CO.: in water at Lake Ella, vicinity of Eustis, Nash 1584.

Florida material examined, by county. Alachua, Bay, Brevard, Citrus, Dade, Franklin, Gadsden, Hernando, Holmes, Indian River, Lake, Okaloosa, Palm Beach, Pasco, Pinellas, Putnam, Taylor, Wakulla.

Xyris smalliana is, along with *X. fimbriata*, one of the most robust of the Florida *Xyris*. Except for its size and exserted lateral sepals it could, however, be mistaken for some larger forms of *X. jupicai*, with which it often occurs.

15. *Xyris jupicai* L. Rich, Act. Soc. Hist. Nat. Paris 1: 106. 1792. Figs. 13, 19. *Xyris caroliniana* Walt. Fl. Car. 69. 1788. *Xyris communis* Kunth, Enum. Pl. 4: 12. 1843. *Xyris elata* Chapm. Fl. S. U.S. 501. 1860. Solitary, or in tufts by short lateral offshoots, soft-based annual or biennial. Leaf linear, 10-60 cm long, 5-10 mm broad, flat to slightly twisted, ascending, smooth to minutely tuberculate along the margins; tip acute; equitant portion gradually broadened to the slightly dilated, yellowish-green or tan base. Scape 20-70 (-90) cm long, terete and one to many-ribbed below, flattened and two to four ribbed above, the ridges smooth or tuberculate scabrid; scape sheathes scarcely inflated above, the divergent blade short. Spike oblong-cylindric to ellipsoidal or ovoid, blunt to acute, 5-15 mm long, of several to many tightly imbricate bracts. Fertile bracts 5-7 mm long, obovate to oval, entire, rounded, tan to castaneous with a gray-green, rectangular to round, dorsal area. Lateral sepals inserted, about the length of the bracts. The keel ragged or sub-entire. Seeds about 0.5 mm long, ovoid, many-ribbed.

Wet sands or sandy peat or roadside ditches, flatwoods pond margins, cypress swamps, and lake shores, Maryland south to Florida and west, chiefly in the Coastal Plain, to Texas and Arkansas.

Type. Not seen by the writer. Type locality, Cayenne.

Florida material examined, by county. Bay, Bradford, Brevard, Broward, Calhoun, Charlotte, Citrus, Columbia, Dade, Duval, Escambia, Franklin, Gadsden, Gulf, Hamilton, Hernando, Highlands, Holmes, Indian River, Jefferson, Lee, Leon, Madison, Okaloosa, Orange, Palm Beach, Pasco, Polk, Putnam, Santa Rosa, Sarasota, Seminole, Taylor, Volusia, Wakulla, Washington.

While Blomquist (1955) recognized *X. caroliniana*, he accepted the name with reservations; the Walter description is indeed inconclusive and could well fit any of at least four species in the genus. Furthermore, it is the opinion of Blomquist (l. c.) and myself that the *X. elata* of Chapman as treated by Malme is nothing more than a form of *X. jupicai*. Herbarium sheets of this latter species show a great variety of identifications: *X. caroliniana*, *X. communis*, *X. elata* and *X. difformis* being names most frequently used. While Gleason (1952) utilizes the inadequately typified Walter epithet "caroliniana" to include the complex, his view is indeed expressive of the difficulties one meets in treating it.

"Variable in stature, leaf-width, size and shape of spikes, and imbrications of the bracts. On the basis of these structures, recent authors distinguish as many as four species within our range, all of which are so connected by intermediate forms that a sharp separation appears impossible, even though the extremes may appear distinct (*X. difformis* Gray, Small; *X. elata*, Gray, B. & B., Small; *X. communis* B. & B., Small)."

The earliest adequately typified name for the spectrum of forms identified as *X. elata*, *X. communis*, *X. caroliniana*, appears to be *X. jupicai* Eich., which is without doubt the commonest, most expressive, and weediest species of *Xyris* in the state of Florida.

16. *Xyris difformis* Chapman, Fl. S. US. 500. 1860. Similar to *Xyris jupicai* but with leaves (broadest toward or above the middle), often pinkish-based, usually with minutely scabrous margins, and flabellately arranged. Scape 20-70 cm long, flattened and conspicuously two-ridged above, the ridges usually scabrid. Spike oblong-cylindric to ovoid, 5-15 cm long, of several to many tightly imbricate bracts. Fertile bracts as in *X. jupicai*. Lateral sepals inserted about the length of the bracts, the keel ragged. Seeds about 0.5 mm long, ovoid many ribbed.

Wet sands or sandy peat of flatwoods pond margins, stream banks, and lake shores, Maryland south to north Florida and west in the Coastal Plain to Texas.

Type. FLORIDA. FRANKLIN CO.: marshes, Apalachicola, Chapman.

This species, so abundant in coastal Virginia and North Carolina, appears to be quite rare in Florida; it is thus surprising that Chapman would have been the first to describe it. The writer, after looking at a number of Florida specimens identified as *X. difformis* but which were actually forms of *X. jupicai*, was not convinced of the distinctness of the former. His concept of *X. difformis* was later clarified through a conversation with Dr. Blomquist and a consultation of material of that species on deposit at the Duke University Herbarium. Unquestionably, populations of this entity which have the flabellately arranged, purplish-based leaves together with broad (by comparison with *X. jupicai*) upper scape ridges are quite distinct.

A difficulty that will probably arise in any revision of the North American species will be in determining the relationships between *X. difformis*, *X. jupicai* and *X. serotina*. Habit and coloration serve to separate most specimens of *X. difformis* from *X. jupicai*, but degree of scabrousness alone serves to separate *X. difformis* from that variety of *X. serotina* which does not have farinose seeds. The description of Walter (l. c.) calls for a species with gladiate leaves but, unfortunately, does not include a comment on scabrousness; thus it could indiscriminately be applied (and has been by some workers) to both *X. difformis* and *X. serotina*. It is not unlikely that future study will disclose subspecies (instead of what we now consider three species, *X. difformis*, *X. serotina*, *X. curtissii*) distinguishable morphologically on the basis of farinose versus clear seeds, degree of scabridity or papillosity, and breadth and flatness of the upper scape. However, this remains to be clarified through the study of an even larger series of specimens than I have worked with at present, together with a careful field appraisal of these taxa over their entire range. — DEPT. OF BIOLOGY, VIRGINIA

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CHANGES IN STATUS AND NEW COMBINATIONS FOR CERTAIN TAXA IN THE OKLAHOMA FLORA¹

U. T. WATERFALL

For more than 20 years the author has been engaged in a study of the Oklahoma flora. During that time he has travelled approximately 140,000 miles within the state, and has made many collections, especially in the areas in, or near, the corners of the state where floristic differences have made the investigations quite interesting.

He has added 235 species, mostly collected by him on these trips, to the known flora of the state. Reports of these, together with descriptions of new taxa and data concerning geographical distributions have been published in a series of 25 papers, the majority of which have appeared in *Rhodora*.

In April, 1960, he made available his "Keys to the Flora of Oklahoma". As the name indicates, it provides keys for the determination of taxa, down through the category of

¹Studies in the Composition and distribution of the Oklahoma Flora — No. 26.

forma, which he currently regards as occurring within the state. This multilithed publication is regarded as a temporary expedient intended to present some usable account of the state's flora, pending its eventual expansion into a Flora.

In these "Keys" a few transfers and combinations are indicated, but not actually made. Name-bringing synonymy is not included, and the author is doubtful if such a temporary publication fulfills well the requirements for effective and valid publication of the International Code.

However, since these combinations should be correctly and effectively published so they may be available for use in the future, they follow below.

Selaginella arenicola Underw., var. *Riddellii* (Van Eselt.) Waterfall, stat. nov. based on *S. Riddellii* Van Eselt., Contrib. U. S. Nat. Herb. 20: 162. 1918. *S. arenicola* Underw., ssp. *Riddellii* (Van Eselt.) Tryon, Ann. Missouri Bot. Gard. 42: 24. 1955.

The author concludes that a ternary combination under *S. arenicola* best indicates the relationship of this taxon. However, it seems that the varietal status is indicated for uniformity of treatment in this area.

Another related taxon should be made available in the category of *varietas* for those who prefer to use this designation for this concept. It is *Selaginella arenicola* Underw., var. *acanthonota* (Underw.) Waterfall, stat. nov. based on *S. acanthonota* Underw., Torreya 2: 172. 1902; *S. rupestris* (L.) Spring, var. *acanthonota* (Underw.) Clute, Fern Allies: 142, 264. 1905; *S. arenicola*, ssp. *acanthonota* (Underw.) Tryon, Ann. Missouri Bot. Gard. 42: 26. 1955.

Eustoma grandiflorum (Raf.) Shinners, forma *album* (Holzinger) Waterfall, comb. nov. based on *Eustoma Russellianum* Griseb., forma *alba* Holzinger, Contrib. U. S. Nat. Herb. 1: 211. 1892. *E. Russellianum*, forma *Fisheri* Standl., Rhodora 34: 176. 1932; *E. grandiflora*, forma *Fisheri* (Standl.) Shinners, Southw. Nat. 2: 41. 1957.

Although brief, Holzinger's description seems adequate to differentiate this taxon from the typical one. It reads "The plants collected in Neutral Strip are white flowered, but otherwise practically like the species. They may, therefore, be known as 'forma *alba*' of this species."

Aster paludosus Ait., var. *hemisphericus* (Alexander) Waterfall, stat. nov. based on *A. hemisphericus* Alexander in Small, Manual of the Southeastern Flora: 1391 & 1509. 1933. *A. paludosus* Ait., ssp. *hemisphericus* (Alexander) Cronquist, Bull. Torrey Club 74: 145. 1947; *Heleastrum hemisphericum* (Alexander) Shinners, Field & Lab. 17: 170. 1949.

In our herbarium we have material from Cherokee, Delaware, Latimer, LeFlore, Mayes, Ottawa, Pushmataha and Sequoyah Counties in eastern Oklahoma.

Gaillardia lanceolata Michx., var. *fastigiata* (Greene) Waterfall, comb. et stat. nov. based on *G. fastigiata* Greene, Pittonia 5: 57. 1902. *G. rigida* Small, N. Am. Fl. 34(2): 135. 1915.

Although the peduncles of much of our material assigned to *G. fastigiata* are definitely shorter than those of eastern material referred to *G. lanceolata*, there is quite a bit of variation in this characteristic, and not all specimens can be assigned easily to either taxon. Therefore it seems more significant to relegate this taxon to the varietal status.

Haplopappus divaricatus (Nutt.) Gray, var. *Hookerianus* (T. & G.) Waterfall, comb. nov. based on *Isopappus Hookerianus* T. & G., Fl. N. Am. 2: 239. 1842. *Haplopappus Hookerianus* (T. & G.) Gray, Syn. Fl. 1(2): 131. 1884; *Croptilon Hookerianum* (T. & G.) House, N. Y. State Mus. Bull. 233-234: 61. 1921; *Isopappus validus* Rydb., Brittonia 1: 100. 1931; *Haplopappus validus* (Rydb.) Cory, Rhodora 38: 407. 1936; *Isopappus divaricatus* (Nutt.) T. & G., var. *Hookerianus* (T. & G.) Shinners, Field & Lab. 18: 157. 1950; *Croptilon divaricatum* (Nutt.) T. & G., var. *Hookerianum* (T. & G.) Shinners, Field & Lab. 19: 134. 1951.

This is the more robust variety with well-developed heads usually 6-10 mm. wide and usually with 10-15 ray flowers per head. It is found over much of Oklahoma, especially in sandy areas, whereas var. *divaricatus*, with heads usually 4-5 mm. wide and usually with 5-7 ray-flowers, is found in southeastern Oklahoma, mostly in McCurtain County.

Haplopappus phyllocephalus DC., var. *annuus* (Rydb.) Waterfall, stat. nov. based on *Sideranthus annuus* Rydb., Bull. Torrey Club 31: 653. 1904. *Haplopappus phyllocephalus* DC., ssp. *annuus* (Rydb.) Hall, The Genus *Haplopappus*, Carnegie Inst. Publ. No. 389. 58. 1928.

This is the only representative of *H. phyllocephalus* found in our state. It is not common, but is found scattered on sand along rivers in the central and western parts of Oklahoma. According to Hall (l. c. supra) it extends to eastern Colorado and southern Texas.

Along the coast of the Gulf of Mexico another variety is to be found. It is *Haplopappus phyllocephalus* DC., var. *megacephalus* (Nash) Waterfall, stat. nov. based on *Eriocarpum megacephalum* Nash, Bull. Torrey Club 23: 107. 1896. *Haplopappus megacephalus* (Nash) Hitchcock, Trans. Kans. Acad. 16: 131. 1899; *Sideranthus megacephalus* (Nash) Small, Fl. Se. U. S. 1185. 1903.

Helenium amarum Raf., var. *badium* (Gray) Waterfall, comb. nov. based on *H. tenuifolium* Nutt., var. *badium* Gray in Wats. Proc. Am. Acad. 18: 108. 1883. *H. badium* (Gray) Greene, Pittonia 5: 55. 1902.

This variety, with its small heads and purple-brown disc-flowers contrasting with the larger heads and yellow disc-flowers of var. *amarum* (*H. tenuifolium* Nutt.), is found in southwestern Oklahoma in the Wichita Mountains and vicinity. — DEPARTMENT OF BOTANY AND PLANT PATHOLOGY AND THE RESEARCH FOUNDATION, OKLAHOMA STATE UNIVERSITY, STILLWATER.

SANDBAGS AS A TECHNICAL AID IN MOUNTING PLANTS.—Sandbags as an aid in mounting plants with glue have recently been tested at the University of Michigan and found to be not only important timesavers, but also a more dependable source of pressure for good mounts. Such bags have been used for years at Kew Herbarium in England. Because of their relative novelty in this country and their proven effectiveness, it was thought that a description of their design and function might be helpful.

When plants are mounted with glue, it is necessary to press them firmly against the herbarium sheet until the glue is dry to achieve good adhesion. Obviously, portions which are able to spring away from the paper will not be fastened securely. If specimens are thin and flat this presents no difficulty. But if they have thick parts that interfere with applying pressure to the thinner parts, some ingenuity is required to insure good contact everywhere. A hickory branchlet with nuts and heavy stems, for example, needs extra care on the leafy portions, so that fruits, stems, and leaves will alike be properly pressed against the paper.

One way to equalize the uneven surfaces of such a specimen is to add pads of appropriate thickness to the thinner portions until a relatively level surface is presented to the applied weight. The pads may be made of folded newsprint, or some other suitable material. This method gives satisfactory results, but often demands a burdensome amount of attention and time.

Sandbags offer a much quicker and simpler solution. After a specimen is undercoated with glue, placed on a herbarium sheet, blotted, and covered with a waxed paper, a sandbag, which is the equivalent of both weight and pads, is laid over it. Fingertips can readily force it to bear down closely on each leaf, fruit, or stem. The bag's lower surface is made to accommodate itself to the contours of the plant, and its upper surface can be neatly smoothed to receive subsequent layers in the stack of processed specimens. Pressure is distributed effectively across each sheet, and from layer to layer. While it is possible to place another herbarium sheet and specimen directly upon the preceding sandbag, it

has been found preferable to insert first a thin section of plywood or fibreboard, or even heavy cardboard, to provide a more rigid area of support. Each glued sheet should rest on a flat, inflexible surface to prevent warping. It is also desirable to place a blotter under each sheet to help remove moisture introduced by the glue. Leaving the bags in place overnight is usually long enough, unless the atmosphere is exceedingly humid. Plants which did not receive proper pressing when collected are greatly improved in flatness and general appearance after treatment with glue and sandbags.

Though the idea of using sandbags as weights was borrowed from Kew, those described here are of a somewhat modified design. Ours at the University of Michigan resemble flat pillows, about $1\frac{1}{2}$ inches thick, slightly wider and longer than standard American herbarium sheets. Tightly woven unbleached muslin was chosen for the fabric, as this material seemed to offer the best combination of strength and flexibility. Mined silica sand was used as the filler, because it is white and relatively dirt-free. A small but perceptible amount of dust unavoidably escapes through the cloth when the bags are kneaded or shifted about. A standard width of muslin available for making bedsheets, 81 inches, was found to yield six bags per yard without waste. Each third of a half-yard, folded and closed with double-stitched half-inch seams, and filled with 12 pounds of sand made a pillow of exactly the right dimensions and maneuverability.

Cost of materials averaged about 29 cents for each bag. The muslin was a dollar a yard, and the sand \$1.39 per hundred pounds. About 18 hours of labor were necessary for cutting, sewing, and filling 54 bags.

If specimens are particularly bulky, and a separate bag is required for every sheet, a mounter may need 35 to 50 bags in a full day of gluing. It appears from our preliminary tests that a worker's output when doing specimens of this type is approximately doubled. The sandbag method is not only quicker, but far less arduous. It appeals greatly to mounters because countless small decisions and stratagems are no longer necessary. The annoyance of providing prop-

er-sized pads, and of storing them away again for future use, is likewise gone. Hence the bags contribute also toward providing pleasanter working conditions. — JENNIE V. A. DIETERLE, UNIVERSITY OF MICHIGAN.

Volume 62, No. 742, including pages 265-294, was issued November 8, 1960.

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